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iArchi[tech]ture: Developing a mobile social media framework for pedagogical transformation

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This paper critiques the journey of pedagogical change over three mobile learning (mlearning) project iterations (2009 to 2011) within the context of a Bachelor of Architecture degree. The three projects were supported by an intentional community of practice model involving a partnership of an educational researcher/technologist, course lecturers, and course students. The pedagogical changes achieved over three years of sustained collaborative participatory action research illustrate the potential for using a community of practice model for supporting pedagogical transformation in broader educational contexts. The Architecture case study thus serves as an example of the ethical, sustained, and collaborative educational technology research called for by Reeves, Herrington, and Oliver (2005) and reiterated by others. We use the concept of the pedagogy-andragogy-heutagogy continuum as a measure of the pedagogical change achieved by the integration of mobile social media within the Architecture curriculum. From our experiences of utilizing mobile social media to support a pedagogical change towards heutagogy we develop a framework for scaffolding a move along the PAH continuum and explore the application of this framework to the establishment of a wider global community of practice (icollab11).

Introduction

Architecture education is traditionally modelled upon a studio-based approach (Brown, 2006) where students work in physical group spaces, guided by an expert lecturer, and culminating in face-to-face presentations of their designs critiqued by their lecturers. In our experience this has typically resulted in a heavily teacher-directed pedagogy focusing upon the delivery of curriculum content by the lecturers and the gate-keeping of this content knowledge by a focus upon a specific physical studio space in which this transfer of knowledge occurs, limiting online engagement to the institutionally hosted learning management system (LMS), and rejecting the use of mobile social media tools for teaching and learning. In this paper we critique a three-year project that investigated the potential for transforming the traditional architecture learning environment via the integration of mobile social media. The goal of the research was to facilitate a move to a learning environment that is a student-directed, involving: team-building, collaboration, and flexible contexts beyond the physical studio environment that empowers students as content producers and learning context generators, guided by lecturers who effectively model the use of the technology. This bridges the formal learning environment of the Architecture Studio and the informal learning environments of situated authentic practice. Brown (2006) calls this "Dewey for the digital age" (p. 23).

> a profoundly social construction of understanding enabled by the Internet. The demand-pull approach draws students into a rich (sometimes virtual) learning community built around a practice. It is passion-based learning, intrinsically motivated by either wanting to become a member of that community of practice or just wanting to learn about, make, or perform something. Formal or informal, learning happens in part through a kind of reflective practicum, but here the reflection comes from being embedded in a social milieu supported by both a physical and virtual presence and inhabited by both amateurs and professionals... Social software enables communities to form and find each other, to learn through remixing, tinkering, and sharing artifacts using the rich media now available. (Brown, 2006, pp. 23-24)

The research involved three iterations of mlearning integration from 2009 to 2011 within the Architecture course. The projects introduced mlearning as a catalyst for pedagogical change, moving from instructivist teacher-directed pedagogy to social constructivist pedagogy, bridging the pedagogy-andragogy-heutagogy (PAH) continuum (Luckin, et al., 2010), (see Table 1).

Table 1:
The PAH continuum (from Luckin, et al., 2010, p. 78)

	Pedagogy	Andragogy	Heutagogy
Locus of control	Teacher	Learner	Learner
Education sector	Schools	Adult education	Doctoral research
Cognition level	Cognitive	Meta-cognitive	Epistemic
Knowledge production context	Subject understanding	Process negotiation	Context shaping

While pedagogy is often used as a general umbrella term to cover all forms of teaching and learning, the PAH continuum defines pedagogy in terms of teacher-directed instruction, with andragogy representing student-centred learning, and heutagogy defined as student-directed learning as typified by doctoral research students. The concept of heutagogy was first proposed by Hase and Kenyon (2001) as an extension of andragogy, and has been built upon by Luckin et al. (2010). More recently Blaschke (2012) has explored the growing literature around heutagogy, in particular with reference to the use of web 2.0 and mobile learning. Luckin et al. (2010) argue that heutagogy need not be the domain of post-graduate research students only, and propose the concept of learner-generated contexts as a framework to help achieve this. We argue that heutagogy does not imply limited or no input from an expert teacher, but on a scale from teacher-directed to student-directed implies a more socio-constructivist approach to learning with student decisions guided by expert teachers. Thus we agree with Luckin et al. (2010):

> It can be argued that the value in a pedagogic approach is in developing the learner's understanding of a subject. The value in an andragogic approach is in developing an understanding of how to negotiate a way through the learning process. The value in a heutagogic approach is in developing the understanding that one is empowered to *look at the learning context afresh* and take decisions in that context. Thus this developmental view implies that learners need to understand how subjects are constructed, what is canonical and, in the sense of learner-generated contexts, that learning is a social process of discussion, negotiation, and partnership, where learning enables you to go out into the world equipped not only to solve problems, but also how to identify new areas worthy of your attention. (p. 78)

The 2009 Architecture mlearning project was an initial exploration of mlearning integration into the Architecture programme. The following 2010 Architecture eCV mlearning project attempted to model the process of moving from pedagogy to andragogy, and towards heutagogy, using mlearning projects focusing upon student-generated learning contexts. This was then extended in the 2011 iArchi[tech]ture project to include international collaboration. The three Architecture mlearning projects provided opportunities for reflection and refinement with the 2009 and 2010 project results informing the design of the 2011 project as we explored the potential for mlearning as a catalyst to transform pedagogy towards heutagogy.

Critical success factors

The 2009 to 2011 Architecture mlearning projects were informed by a wider mlearning research project begun in 2006 and spanning almost thirty completed projects by the end of 2010 (Cochrane, 2010a). Situated within an action research study spanning six years and seven different course contexts (or case studies) within the Faculty of Creative Industries and Business at New Zealand's largest Polytechnic including: architecture; performing and screen arts; landscape design; product design; contemporary music; computing and information systems; and accountancy and finance. Analysis of the outcome of these 30 projects led to the identification of six mobile social media critical success factors (Cochrane, in

press) and development of strategies to support these critical success factors (Cochrane & Bateman, 2011a). These included:

1. The pedagogical integration of the technology into the course and assessment.
2. Lecturer modelling of the pedagogical use of the tools.
3. Creating a supportive learning community.
4. Appropriate choice of mobile devices and web 2.0 social software.
5. Technological and pedagogical support.
6. Creating sustained interaction that facilitates the development of ontological shifts, both for the lecturers and the students.

These six critical success factors are used to critique and analyse the 2009 to 2011 Architecture mlearning projects.

Scaffolding social constructivist pedagogy

The six critical success factors indicated that significant technical and pedagogical support is crucial for both the lecturers and students appropriating mlearning (Cochrane, 2010b, 2011). The establishment of supportive learning communities in the form of an intentional community of practice (Langelier, 2005; Wenger, White, Smith, & Rowe, 2005) was utilized to meet the need of this longitudinal support. Intentional communities of practice (COP) are formed around a specific goal, yet are distinct from teams by the nature of participation as peers and the drawing in of members over time from legitimate peripheral participation into potential full participation within the community. Wenger's (2006) conception of communities of practice does not preclude intentionality, "this definition allows for, but does not assume, intentionality: learning can be the reason the community comes together or an incidental outcome of member's interactions" (p. 1). A strategy for pedagogical and technological support for the integration and implementation of mobile social media was developed using an intentional COP model (Cochrane, 2007; Cochrane & Kligyte, 2007).

Mlearning a catalyst for pedagogical change

In defining mlearning we use the generic term wireless mobile devices (WMDs) to cover a range of portable internet connected devices such as smartphones, netbooks, and new touch-screen tablet devices including the iPad. The unique potential impact of WMDs (particularly smartphones) on education is founded upon their rise to almost ubiquitous ownership (ITU, 2009) and their primary functionality as ubiquitously connected communication devices. These two characteristics of Wireless Mobile Devices enable their use as disruptive devices to act as catalysts for pedagogical change by mediating student-generated learning contexts and sharing student-generated content as key elements of social constructivist learning or Pedagogy 2.0 (McLoughlin & Lee, 2008). The 2010 JISC mobile review (Belshaw, 2010) concludes that mobile learning presents the potential to drive innovation in education:

> Mobile learning may mean different things to different people, but it is the dialogue that an institution begins with itself, its' staff, its' learners, its' community - that matters. It is certainly not time for 'business as usual'. It is time to define and start driving innovation. (p. 63)

This potential for innovation is both driven and hampered by the rate of change in mobile technologies. Although the rate of change of mobile technology is very high the choice of a pedagogical framework and foundational pedagogical theory can guide the appropriate pedagogical use of current and future WMDs developments. The rise of mobile application ecosystems (for example: the iTunes store for dissemination of iOS WMDs, applications and media, Android Play -formerly Market- for Android WMDs, and the Nokia Ovi store for Symbian based WMDs) that bridge information, content and productivity with laptop or desktop computing via web 2.0 platforms, has created a mobile learning framework that can be easily appropriated by a wide range of educators without requiring specialist computing skills, creating the potential for mainstream adoption of mlearning in tertiary education. WMDs can be utilized as content creation devices for students' online e-portfolios, and for establishing a digital identity that can become a key element of their ongoing professional careers. WMDs can also be utilized as communication and collaboration tools leveraging an increasing range of mobile social networking tools. Mobile learning

(mlearning) has moved beyond the realms of fantasy to become a viable platform for contextual learning that bridges formal and informal learning environments in and beyond the classroom. However, the bulk of the literature on mlearning research projects does not bear witness to significant pedagogical change, rather the focus has been upon delivery of teacher-generated content to mobile devices rather than empowering student-generated content (Herrington & Herrington, 2007; Kukulska-Hulme & Traxler, 2005; Traxler, 2007). Herrington & Herrington (2007) note that the disruptive nature of the integration of new technologies in education often results in practitioners relying upon tried and proven pedagogical approaches, leading to "one step forward for technology and two steps back for pedagogy" (p. 4). In light of the tendency of educational technology to create no significant difference in learning outcomes Reeves makes a plea for new approaches to technology adoption research in education: "Instead of more media comparison studies or studies investigating the effects of isolated media variables" (T. Reeves, 2009, p. 6). Reeves (2005) calls for four major changes in educational technology research and adoption:

1. A new research methodology, elaborated in (T. Reeves, 2009): Design research. "Design research requires intensive, on-going collaboration among researchers and practitioners to design and refine prototype e-learning environments tailored to the unique contexts in which they will be used." (T. Reeves, 2009, p. 2);
2. New support strategies;
3. New reward strategies and recognition of the scholarship of teaching; and
4. New methods of disseminating research to practitioners, for example open access publications that will be read by practitioners as well as researchers.

Mlearning researchers need to move beyond a focus on information delivery via the institutional Learning Management System (LMS) or replicating current pedagogies on mobile devices. Herrington Reeves, & Oliver (2005) term this fascination with limiting technology appropriation in education within the official LMS as "digital myopia". We have argued that utilizing freely available mobile social media tools for social constructivist learning provides a way of correcting digital myopia (Cochrane, 2012; Cochrane & Bateman, 2010). The iArchi[tech]ture case study illustrates that significant pedagogical change is possible as a result of mlearning integration when it is explicitly part of the design goal of technology integration innovation in teaching and learning.

Research methodology

The research involved a partnership between the researcher, the Architecture course lecturers, and the Architecture students involved in each successive mlearning project. The researcher's role was that of the primary collector of data, and the technology steward (Wenger, White, & Smith, 2009; Wenger, et al., 2005) within the communities of practice developed to support each Architecture mlearning project. The research approach adopted was thus participatory action research (Swantz, 2008; Wadsworth, 1998).

The core data gathering tools used in this research consisted of:

1. Pre-project surveys of lecturers and students, to establish current practice, expertise and experience.
2. Post-project surveys and focus groups, to measure the impact of the wireless mobile computing environment, and to identify emergent themes.
3. Lecturer and student reflections via their own blogs and e-portfolios during the project, collated via RSS feeds in Google Reader.

The research used the technologies that were an integral part of the projects, such as participant blog posts, peer blog comments, and VODCast reflections to capture data on the progression and impact of mobile social media on the participants' learning experience. Participant feedback and focus group questions were transcribed and collated to allow the identification of emergent issues and themes.

The 2009 architecture mlearning project

An Architecture lecturer COP was established in the first semester of 2009 to investigate the potential of mobile social media to enhance the programme. This resulted in the development of a plan for modifying the second year Architecture studio course in the second semester of 2009. Thus the 2009 mlearning project was instigated across the second year Bachelor of Architecture course at Unitec and involved 135 students and 9 lecturers. An initial pre-project survey of the 2009 Architecture students revealed that

contrary to the notion of "digital natives" (Prensky, 2001) their previous technology usage indicated that they were predominately consumers of web 2.0 rather than producers (see Figure 1).
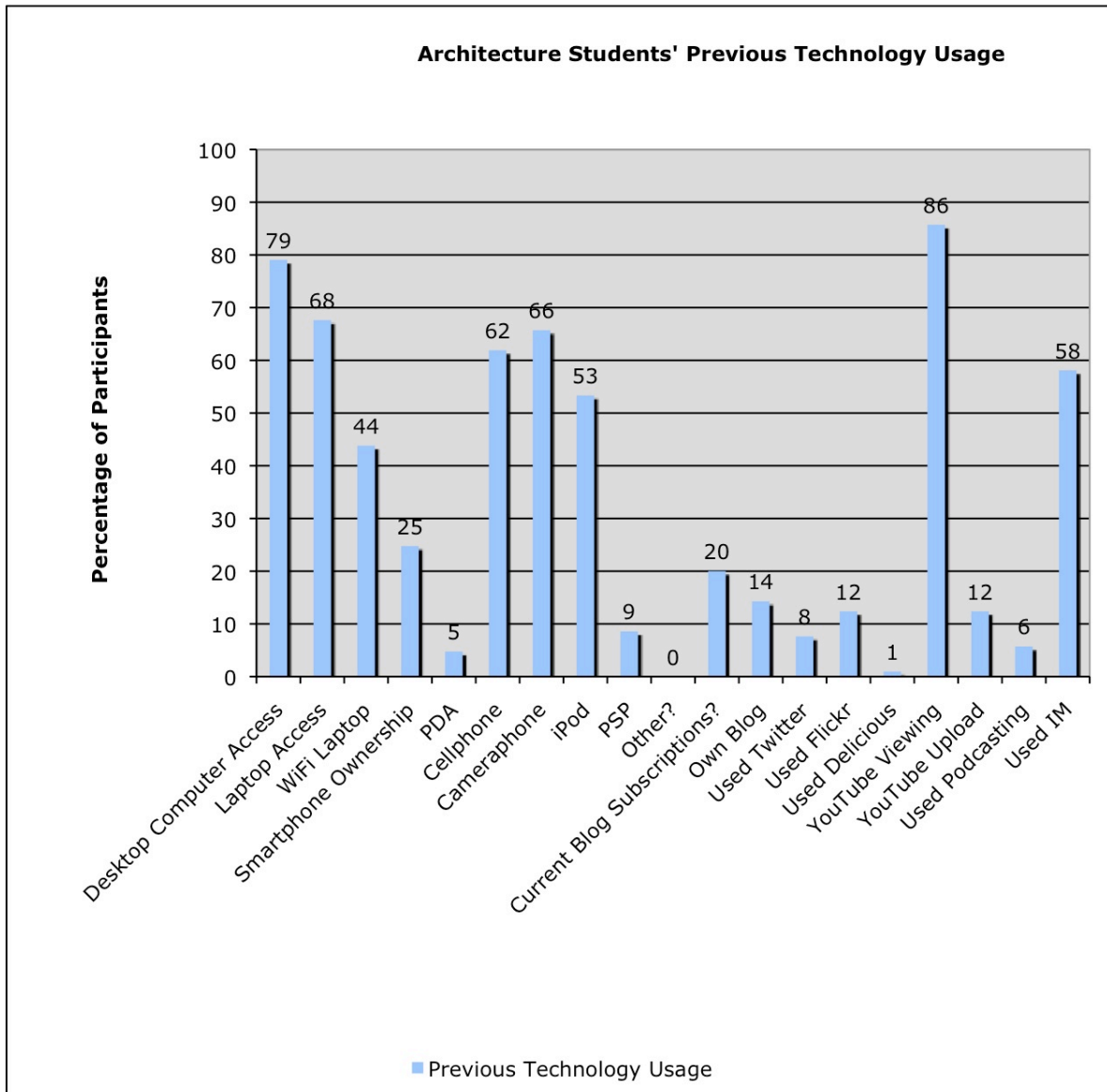

Figure 1. Pre-project student survey results 2009.

The introduction of mlearning and student-generated e-portfolios was therefore a completely new experience for both the lecturers and students. All of the second year Architecture students and lecturers were supplied with a Nokia smartphone (the Xpressmusic 5800), and a 3G/wifi capable netbook (the Dell Mini9), which they used throughout the length of the course.

As critical success factor 1 (CSF1) highlighted the level of integration of the technology into the course and assessment (Cochrane, 2010b), the negotiated plan for the 2009 Architecture mlearning project was to include the use of moblogging within the second year Architecture compulsory Studio course as a new form of documenting, sharing, and critiquing students' individual and group design projects. However, the studio-coordinator lecturer responsible for setting the assessments for the course had declined to be involved in the lecturer COP and decided not to allow the integration of mlearning into the course assessment. Discussions held between the researcher, the COP participants, and the studio-coordinating lecturer did not manage to bridge this impasse. The reasons cited by the coordinating lecturer were: "Architecture is not interested in process, only the final design, and therefore design journaling will not benefit the course", and secondly, "In the Studio course the face-to-face interaction is of primary

importance". While both of these assumptions were hotly debated, the coordinating lecturer refused to be persuaded. From the researcher's perspective, it appeared the root of the dispute was really about the threat of the project to the centralized control imposed upon the course by the coordinating lecturer. Within the context of the research, the ontological leap (Chi & Hausmann, 2003) from lecturer-focused pedagogy to a social constructivist pedagogy facilitated by mobile social media was too much for the coordinating lecturer to bridge. Also the potential for mobile social media to create or enhance context-independent learning communities was beyond the lecturer's experience and ability to conceptualise. Thus the 'disruptive' nature of mlearning was viewed by the coordinating lecturer in a negative light, rather than positively. However, the lecturers who had been involved in the COP were keen to continue the project. Thus, the mlearning project became a voluntary option for the second year Architecture students rather than integrated into the course assessment as had been planned, but was promoted and supported by the lecturers involved in the architecture COP (six of the nine second year lecturers). While this was a definite setback for the 2009 project, it was decided to go ahead as a proof-of-concept exploration. The project resulted in a positive student response with a third of the students voluntarily engaging with mobile blogging for the first time. Collated focus group responses at the end of the project were predominantly positive about the impact of the project.

> MLearning presents immense possibilities in the field of Architecture, particularly in the student crit area I believe. For example, facilitating the recording of crits and student feedback – they often say they can't remember what they said or did during the crit. This enabled them to record their crits and even for them to do their own pre-crit recording in order to gain some confidence in this area. (Architecture lecturer, 2009)

> Overall the idea is successful to integrate technology more into work/study/life. The laptops are good but must have more memory. The phones need to become more like the business Blackberry or iPhone. (Architecture student, 2009)

Reflections on the 2009 mlearning project led to a rethink of the project implementation to avoid the non-participating lecturers derailing the project in 2010.

The 2010 eCV project

A smaller sized mlearning project (20 students and 3 lecturers) was subsequently developed and implemented in 2010. This project was centred on an elective course in which students had previously been taught how to create an electronic curriculum vitae (eCV) using Flash and HTML. This elective course was rewritten as a collaborative project between the researcher and the key Architecture lecturers from the 2009 project. The new focus of the 2010 eCV elective course became the development of a learning community that modelled a progression from pedagogy to heutagogy using mlearning as a catalyst. The 2010 eCV10 Architecture mlearning project investigated bridging student generated e-portfolios and digital story-telling facilitated by the latest generation of mobile devices, allowing the capture and organization of this content to be contextualized within authentic environments beyond the classroom. Lecturers and students were provided with an Android smartphone (HTC Desire) and an Apple iPad for the duration of the semester-long project. Students worked in four negotiated teams, initially proposing a group eportfolio project that utilized the unique affordances of the mobile tools. The student groups then used the smartphones to capture geotagged photos and videos, and to digitally augment the real world with augmented reality applications such as: creating points of interest for augmented reality browsers Wikitude and Junaio, QR Codes, and Google Maps. Media captured via the smartphones was then collated and edited using the iPads – while on location, previewed using mobile laser Pico projectors, and uploaded to their e-portfolios from the point of capture using 3G connectivity facilitated by mobile broadband hotspots enabling the students to connect in small teams, sharing resources and connectivity. Additionally, student project designs were previewed and pitched to clients on location using these mobile technologies, creating a direct connection between the site and the design.

Building a learning community

Within the eCV course the students were involved in negotiating the parameters of both the projects and the assessment. New mlearning technologies (the iPad and HTC Desire smartphone had only just been released at the start of the course in NZ) were used as catalysts of pedagogical change: both for the

lecturers' conception of teaching, and for the students' conception of learning. A key component was the development of a supportive learning community, that is, an intentional COP including the course lecturers, the students, and a technology steward - creating sustained technological and pedagogical support throughout the course, leading to sustained engagement and pedagogical paradigm shifts for the participants across the length of the course. The COP began as weekly lunchtime meetings of the participants to learn and explore the affordances of the Android smartphones and mobile social media. This was followed by a weeklong intensive workshop during the semester break where the students negotiated the student teams and team projects with their lecturers. During this week the participants also learnt how to use the iPads, and investigated a variety of mobile social media tools such as: Twitter, Picasaweb, Qik, Wordpress, geotags, QR Codes. Two days of the workshop week were spent with the student teams dispersing around Auckland city capturing their ideas and content using the mobile devices, and staying in communication with the other teams and their lecturers via regular Twitter messages. The weekly lunchtime COP continued after the semester break and culminated in the student teams presenting their projects to the group, followed by presentations to the wider public during the end of year Graduation Show.

Examples of student-generated projects

Projects using a combination of iPads and HTC Desire Android smartphones in the context of this third year Architecture eCV course at Unitec New Zealand included:
1. Archichur (http://archichur.wordpress.com/)
2. OneManaBach
   (http://www.youtube.com/watch?v=zWmbNKumKMw&feature=player_embedded)
3. Archifail (http://prezi.com/byy1rnidvw-i/archifail/)
4. Undiscovered Auckland (http://undiscoveredauckland.wordpress.com/about/)

These team projects were brainstormed and negotiated by the students with the course lecturers, an approach that represented a paradigm shift from pedagogy (teacher-directed) towards heutagogy in tertiary education. For example, the Archifail team project captured images and mobile videos highlighting and critiquing poor Architectural design around Auckland City. The team created a Wordpress portfolio (http://archifail.wordpress.com), and also created a layer for the Wikitude augmented reality mobile browser. This Wikitude layer included geographically tagged locations of failed Architectural design, supplemented with images and a short critique by the students of the design failures. Anyone with a compatible smartphone could then download the Archifail layer to Wikitude and use the smartphone's built-in camera coupled with its GPS and compass to locate these points of interest overlaid as digital information on the real-world viewed through the smartphone's camera.

These 2010 student collaborative projects, and the framing of the elective course around a community of practice with both the students and lecturers (alongside the researcher) represented a significant change to the pedagogy of the Architecture programme, and enabled bridging student-generated learning contexts beyond the traditional physical Architectural studio space. The student team e-portfolios created as a result of each project became boundary objects (shared artefacts) of the supporting community of practice that were then used to gain interest from students and lecturers on the periphery of this COP within the rest of the Architecture department. Students even created tutorials for their classmates on how to utilize certain mobile social media applications and posted these on their blogs. This approach resulted in a much deeper learning experience for the students, as illustrated by end of the project blog reflections such as the following:

> We were given these awesome phones for a semester thanks to Thom, David and Unitec. We were encouraged to experiment with the overwhelming list of applications on this phone. At first I was not too sure, but once I browsed through the Android market, I spent hours at end just looking for interesting applications, it almost became an addiction! We were introduced to some basic programs like Audioboo (stream live audio from your phones), pixel pipe (upload pictures and videos from your phone), Layar and Wikitude, which are, augmented reality applications. I was really intrigued by the augmented reality applications... I have really learnt a lot about android phones and the possibilities of incorporating the various applications within our study. And the best part is ease of getting

data from the phone straight online. Using this phone has been such a pleasure that I will be saving up to buy my very own HTC Desire! (Architecture student, 2010)

This class has touched on what's possible, and encouraged the students to get their presence established on the Internet. They have also learned employers do have access to the Internet and observe what the students put out there. (Architecture lecturer, 2010)

iArchi[tech]ture 2011: Enabling global collaboration

Building upon the successful integration of mobile web 2.0 within the third year of the Bachelor of Architecture course in 2010 and similar projects within the context of a Bachelor of Product Design course (Cochrane & Bateman, 2011a, 2011b) the researcher and course lecturers collaborated during 2011 to establish, explore, and expand heutagogical approaches to higher education supported by intentional communities of practice into a global community of practice across multiple learning contexts (Buchem, Cochrane, Gordon, Keegan, & Camacho, 2012; Cochrane et al., 2011). Thus in 2011 the eCV elective third year Architecture course was renamed iArchi[tech]ture to reflect the conceptual shift that had occurred with the development of the 2010 eCV course. The focus was no longer simply on empowering students to create e-portfolios, but now to explore student-directed (heutagogy) projects supported by a community of practice empowered by mobile social media tools. The 2011 iArchi[tech]ture course formed the foundation for brokering the establishment of similar projects exploring heutagogical approaches to higher education enabled by mobile social media within a global collaborative project involving six institutions and four countries in 2011, entitled the icollab11 project.

Building a global learning community

The icollab11 project began with the lecturers modelling international collaboration themselves as they formed an international community of practice using a range of mobile social media collaboration and communication technologies while co-creating ideas for curriculum integration of these tools (Buchem et al., 2012; Cochrane et al., 2011). The researcher acted as an initial broker and technology steward for the group. The international lecturer COP was scaffolded by the use and exploration of the following mobile social media tools:

- Google Docs for an initial outline of the project and its goals, accessible by mobile devices.
- A group wiki for development of the ideas (http://icollab11.wikispaces.com/)
- Skype for initial brainstorming and voice meetings, followed by weekly Google Plus Hangouts creating a group 'circle' for the project accessible anywhere via the mobile Skype and G+ apps.
- Twitter as a core asynchronous mobile communication tool to bridge time zones.

The icollab11 participants included groups of students in: New Zealand, Spain, Germany, and the United Kingdom.

Examples of student-generated projects

Outlines of the six learning contexts and their student projects are elaborated in a previous paper (Cochrane, et al., 2011) and at http://icollab11.wikispaces.com/Timeframes+and+Course+Outlines. Links to example student-generated media and presentations during the icollab11 project are collated on the wiki page http://icollab11.wikispaces.com/StudentPresentationLinks. Building on the success of the 2010 eCV project, the 2011 iArchi[tech]ture student teams within the elective course took this approach further, establishing partnerships with local councils to create Wikitude augmented reality layers promoting local events and attractions, with one team entering into a commercial agreement with Auckland City Council based upon their project (http://explorewynyardquarter.wordpress.com/).

Students were encouraged to create team projects relevant to their learning contexts and then use mobile social media communication and collaboration tools to share these among the other groups and invite interaction. Core tools utilised included: Twitter on smartphones, short YouTube video introductions recorded on smartphones, individual and group blogs (editable and readable via smartphones), Polleverywhere allowing SMS voting, wikis, Google Plus, and Storify (for collating and curating student-generated mobile web 2.0 content), and augmented reality mobile browsers such as Wikitude for sharing

student-generated geotagged data. The student-generated mobile social media content from each of the physical course COPs effectively reified their activity and were used as boundary objects (Star, 2010) to broker (Wenger, 1998) interaction between each COP, creating participation within the wider virtual international COP (icollab11).

For example:
- Architecture students created tutorials on how to develop geolocation-based projects using the Junaio augmented reality platform, and shared these with the other participating groups of students via Wordpress. (e.g., http://megkoolaid.wordpress.com/tutorials/).
- Salford University (UK) students created YouTube tutorials (e.g., http://www.youtube.com/watch?v=ni-xNhit1EQ&list=PL546B03EE313199EF&index=41&feature=plpp_video) on how to create social media for the Architecture (NZ) students to empower the local residents during their fieldtrip to Haiti while exploring building projects for aid, as recorded on their group blog (http://archstudentsforhumanity.wordpress.com/).
- All students and lecturers participating in the icollab11 project created and shared short mobile video introductions and shared these on a YouTube playlist (http://www.youtube.com/playlist?list=PL546B03EE313199EF&feature=mh_lolz) to nurture a sense of community.
- AUT (NZ) students created and shared via Twitter mobile polls eliciting feedback on the Rugby World Cup from all of the participants.

The following are examples of student and lecturer feedback on the project.

> I found the iarchi[tec]ture course to be interesting and informative. I was exposed to a broad range of technologies including apps, hardware, and social networking and marketing tools. The course provides a good platform for enhancing an online presence, which is vital to creative professionals in a competitive market. While the loose structure of the course suits the need for flexibility and creativity in proposing projects, a lack of structured assignments or requirements seemed to reduce the priority students placed on the class until the very end of the semester. Firmer progress checks would counteract this. (Architecture student, 2011)

> Increasingly, educators are connecting; networks grow and overlap; we're connecting diverse groups of students across the globe through both ad-hoc informal projects, and more formal approaches where they are assessed/accredited by their own institutions while working together on a common brief. It's exciting and potentially rather messy. (icollab lecturer, 2012)

Feedback from the participating lecturers was very enthusiastic as they reflected upon the transformation of the learning experience for their students during the 2011 project. Both lecturer and student feedback highlighted the tension between enabling student-directed creativity and providing sufficient structure around the projects. However, the framing of the projects around a supportive community of practice of the participants mitigated this ontological shift in both the roles of the lecturers and the students as we moved towards a heutagogical approach.

Discussion

This section discusses the impact of the 2009 to 2011 mlearning projects upon the Architecture programme, and the implications for subsequent projects.

A journey from pedagogy to heutagogy

Table 2 provides a summary of the three Architecture mlearning project iterations.

Table 2
Three Architecture mlearning project iterations

	2009	2010	2011
Participants	135 students	25 students	150 students
	9 lecturers	4 lecturers	6 lecturers
			5 countries
Context	Developing studio e-portfolios	eCV: Developing mobile e-portfolios	iArchi[tech]ture: International collaboration
Mobile devices	Nokia smartphone	Android smartphone	iPhone, iPad, and a variety of student-owned devices
	Netbook	iPad	
Mobile social media	Vox	Wordpress	Wikispaces
	QR Codes	Wikitude	Wordpress
	YouTube	Prezi	Twitter
	Qik	Qik	YouTube
	Twitter	Twitter	Wikitude
	Moodle	YouTube	QR Codes
		Google Reader	Prezi
			Qik
			Skype
			Polleverywhere
			Google Reader
Pedagogical focus	Teacher-directed (pedagogy)	Student-centred (andragogy)	Student-directed (heutagogy)

The 2009 Architecture mlearning project was the first attempt at integrating mlearning into the architecture curriculum, and, as has been found with each mlearning case study throughout the length of the research, the impact of the first mlearning project within a new context is predominantly in creating awareness of the pedagogical potential of mlearning and awakening the lecturers and students to the necessary ontological shift towards social constructivism that mobile social media facilitates (Cochrane, 2010b). As Herrington and Herrington (2007) noted, when introducing the use of new technologies into a course, educators tend to rely upon established pedagogical practice rather than embracing the unique pedagogical affordances of the new technologies. When faced with the introduction of mobile social media into the Architecture course, the non-participating lecturers reacted by strongly asserting the appropriateness of the traditional architectural design studio and their previous teaching strategies. However, the mlearning project did present a window into the potential of a design studio pedagogy that was not bound by a predetermined physical space. So while the first mlearning project implementation did not transform the pedagogy of the course, it set the foundation on which to build this transformation in subsequent iterations. Although voluntary establishment of a supporting virtual learning community was achieved involving almost a third of the Architecture students, the lack of integration into the course

assessment limited the impact of the mlearning project. Key lecturers who did not engage with the pre-project mlearning COP presented a gap that could not be bridged during the implementation stage of the project. Finding an appropriate way of bringing these lecturers from the periphery of the mlearning community of practice and into the core of the COP required some creative thinking. Thus the subsequent 2010 Architecture mlearning project focused upon developing a core group of lecturers and students within the programme to become a hub of technology stewards (both lecturers and students) from which others could be drawn in from the periphery of the mlearning community of practice. The participants of the 2010 eCV COP created an air of excitement around the project, drawing interest from other students and lecturers. This was built upon in 2011.

Going global: Informing the 2011 icollab11 project

The 2011 mlearning project developed further the conceptual shifts introduced by the 2010 Architecture eCV mlearning project. The 2011 project aimed to produce a significant core group of mlearning evangelists from lecturers and students within the Architecture department. The 2011 project also widened the scope of the 2010 project by incorporating international collaboration between the Architecture elective course students in New Zealand and groups of students in both the UK (Sheffield University), Spain (Tarragona University), and Germany, where the researcher has established partnerships with lecturers keen to explore the potential of mlearning integration. This international collaboration added another dimension to student teamwork with students utilizing the communication and collaboration affordances of smartphones (for example Twitter, and Qik mobile video streaming) as they formed international teams and negotiated learning outcomes and team projects with the lecturers in all three countries. Thus a virtual community of practice made up of the participants from all four countries also augmented each local physical community of practice.

Thus the development of a framework for integrating mobile web 2.0 supported by sustained collaborative research via an intentional community of practice led to the establishment of an international project involving multiple courses supported by an international lecturer community of practice, facilitating pedagogical shifts towards heutagogy within each of the participating countries context. Informed by the icollab11 experiences the icollab COP continues as reified by the icollab project (http://icollab.wordpress.com). The icollab COP that emerged out of the iArchi[tech]ture project has been formed out of a combination of collaborative educational technology research supported by the sustained interaction of an intentional community of practice, and is similar to the model that Reeves (2005, 2009) calls for. Reeves argues that new approaches to educational technology research are needed that move beyond the typical comparative short-term projects found across the literature exhibiting no significant difference in pedagogical outcomes. Laurillard (2012) has recently made a similar call for redesigning higher education: "The basic argument is that a 21st century education system needs teachers who work collaboratively to design effective and innovative teaching, and digital technologies are the key to making that work" (p. 1). The iArchi[tech]ture project has resulted in the establishment of an international COP of lecturers committed to researching and putting into practice heutagogical approaches to higher education enabled by mobile social media.

A mobile social media framework for scaffolding the PAH continuum

CSF4 implies that mlearning projects need to focus upon the unique affordances of WMDs rather than replicating what can be done on a laptop computer on a smaller screen. The 2009 Architecture mlearning project represented an initial first step, focusing upon the general mobile blogging affordances of smartphones. The 2010 Architecture mlearning project focused upon the unique affordances of smartphones with relevance to Architecture and student eportfolio generation facilitating situated learner-generated content, including: geotagging of images and video, augmented reality (e.g., Wikitude), microblogging (e.g. Twitter), and mobile codes (e.g. QR codes). The 2011 iArchi[tech]ture project went further - forming the foundation for exploring mobile social media as a catalyst for enabling heutagogical approaches to higher education for international collaboration as outlined in Table 3.

Table 3 illustrates the alignment between a move along the PAH continuum, the implementation of the researcher's six critical success factors, and the ontological shifts required of the lecturer and student participants. These shifts were supported in thus framework by the establishment and nurturing of an intentional community of practice around each project. The locus of control in learning develops across

the length of a course from teacher-directed initial establishment of the project and induction into a community of practice, to andragogy as the students personally appropriate the use of the mobile social media tools, and then the structure of the course changes to culminate in student-directed collaborative projects enabled by the unique affordances of mobile social media.

Table 3
A framework for using mobile social media to enable a move towards heutagogy

	Pedagogy	Andragogy	Heutagogy
Locus of Control	Teacher	Learner	Learner
Course timeframe and goal	Initial establishment of the course project	Early to mid-course: Student appropriation of mobile social media	Mid to end of course: Establishment of major project where students actively participate within an authentic community of practice
Cognition Level	Cognitive	Meta-cognitive	Epistemic
Knowledge production context	Subject understanding: lecturers introduce and model the use of a range of mobile social media tools appropriate to the learning context	Process negotiation: students negotiate a choice of mobile social media tools to establish an eportfolio based upon user-generated content	Context shaping: students create project teams that investigate and critique user-generated content within the context of their area of discipline interest. These are then shared, curated, and peer-reviewed in an international COP
Supporting mobile social media affordances	Enabling induction into a supportive learning community	Enabling user-generated content and active participation within a supportive learning community	Enabling collaboration across user-generated contexts, and active participation within a global COP
Alignment with critical success factors	CSF 1,2,3	CSF 4,5	CSF 5,6
Ontological shift	Reconceptualising mobile social media: from a social to an educational domain	Reconceptualising the role of the teacher	Reconceptualising the role of the learner

Conclusions

The 2009 to 2011 Architecture mlearning projects represent action research iterations illustrating a journey from traditional physical face-to-face studio based pedagogy towards heutagogy via mlearning enabling learner-generated contexts, resulting in the development of a framework for supporting this pedagogical shift. The 2010 mlearning project built upon the lessons learnt during the 2009 project, resulting in significant pedagogical change. The willingness of the core participating lecturers to become involved in a collaborative community of practice with their students presents both exciting opportunities and challenges for continued pedagogical transformation throughout not only the department of Architecture, but internationally into other countries in 2011 and beyond as the lecturers explore international collaboration via an international community of practice (icollab) that is enabled and nurtured by the use of mobile social media tools. This framework is potentially transferable into a variety of educational contexts, and will be tested within a range of contexts in future projects.

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